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(FILE 'HOME' ENTERED AT 12:55:41 ON 10 SEP 96)


        FILE 'COMPUAB, COMPUSCIENCE, ELCOM, INFODATA, MATH, SOLIDSTATE'
        ENTERED AT 12:55:53 ON 10 SEP 96
L1        12670 FILE COMPUAB
L2        11078 FILE COMPUSCIENCE
L3         2527 FILE ELCOM
L4         5075 FILE INFODATA
L5         9409 FILE MATH
L6          505 FILE SOLIDSTATE
        TOTAL FOR ALL FILES
L7        41264 S SCHEDULING OR PLANNING OR MRP OR CRP OR FCS
L8         9112 FILE COMPUAB
L9         7798 FILE COMPUSCIENCE
L10        2774 FILE ELCOM
L11         673 FILE INFODATA
L12       16834 FILE MATH
L13         723 FILE SOLIDSTATE
        TOTAL FOR ALL FILES
L14       37914 S CONSTRAINT?
L15       10050 FILE COMPUAB
L16       11481 FILE COMPUSCIENCE
L17        2718 FILE ELCOM
L18         515 FILE INFODATA
L19       31253 FILE MATH
L20         664 FILE SOLIDSTATE
        TOTAL FOR ALL FILES
L21       56681 S (LOOKAHEAD OR LOOK?(W)AHEAD OR HEURISTIC? OR ITERAT?)
L22        3264 FILE COMPUAB
L23        2530 FILE COMPUSCIENCE
L24        1884 FILE ELCOM
L25          99 FILE INFODATA
L26        7224 FILE MATH
L27        4923 FILE SOLIDSTATE
        TOTAL FOR ALL FILES
L28       19924 S REPAIR? OR RELAX?
L29          16 FILE COMPUAB
L30          22 FILE COMPUSCIENCE
L31           2 FILE ELCOM
L32           0 FILE INFODATA
L33          22 FILE MATH
L34           1 FILE SOLIDSTATE
        TOTAL FOR ALL FILES
L35          63 S L7 AND L14 AND L21 AND L28
L36          11 FILE COMPUAB
L37          16 FILE COMPUSCIENCE
L38           1 FILE ELCOM
L39           0 FILE INFODATA
L40          15 FILE MATH
L41           0 FILE SOLIDSTATE
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        TOTAL FOR ALL FILES
L42          43 S L35 NOT 1995-1996/PY
L43          33 DUPLICATE REMOVE L42 COMPUAB (10 DUPLICATES REMOVED)
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L43     ANSWER 1 OF 33  COMPUSCIENCE  COPYRIGHT  1996 FIZ KARLSRUHE

AN      96(6):CS5117  COMPUSCIENCE

TI      A unified partitioning and scheduling scheme for mapping multi-stage regular iterative algorithm onto processor arrays.

AU     Hwang, Yin Tsung; Hu, Yu Hen

SO     Journal of VLSI Signal Processing. (Oct/Nov 1995) v. 11(1/2), p. 133-150.
Boston etc.: Kluwer Academic Publishers.
ISSN: 0922-5773

DT     Journal

TC     Theoretical

CY     United States

LA     English

IP     FIZKA

AB     The paper addresses the partitioning and scheduling problems in mapping multi-stage regular iterative algorithms onto fixed size distributed memory processor arrays. We first propose a versatile partitioning model which provides a unified framework to integrate various partitioning schemes such as ``locally sequential globally parallel'', ``locally parallel globally sequential'' and ``multi-projection''. To alleviate the run time data migration overhead --- a crucial problem to the mapping of multi-stage algorithms, we further relax the widely adopted atomic partitioning constraint in our model such that a more flexible partitioning scheme can be achieved. Based on this unified partitioning model, a novel hierarchical scheduling scheme which applies separate schedules at different processor hierarchies is then developed. The scheduling problem is then formulated into a set of ILP problem and solved by the existing software package for optimal solutions. Examples indicate that our partitioning model is a superset of the existing schemes and the proposed hierarchical scheduling scheme can outperform the conventional one-level linear schedule.

L43     ANSWER 2 OF 33  COMPUSCIENCE  COPYRIGHT  1996 FIZ KARLSRUHE

AN     95(8):AC50581  COMPUSCIENCE

TI     Intelligent scheduling.

AU     Zweben, Monte; Fox, Mark

SO     San Francisco, CA: Morgan Kaufmann Publishers Inc. 1994. 754 p.
ISBN: 1-55860-260-7

DT     Book

LA     English

IP     ACM-CR

DN     9508-0581

AB     Scheduling problems have been studied in the field of operations research (OR) for decades. Although substantial progress has been made in developing methods and algorithms to solve various scheduling problems, efforts to apply this theoretical work to solve realistic problems have not been very successful. The reasons are that problems solved in OR are too formalized, with a few

parameters, and that algorithms devised by OR researchers demand exact knowledge about job characteristics and time and resource constraints. Real scheduling problems exhibit uncertainty in job descriptions, and vagueness in constraint specifications. Therefore, analytical approaches that solve scheduling problems in static settings are inappropriate in practical scheduling domains, which rarely meet the idealistic assumptions made by OR algorithms. Since the early 1980s, scheduling problems have attracted the attention of the artificial intelligence (AI) community, and AI approaches to solving realistic planning and scheduling problems have been developed considerably. Knowledge-based representation and search techniques have resulted in many effective and efficient systems that can solve large-scale and complicated real-world scheduling problems. Written by 50 leading researchers from industries, universities, and government agencies, this book presents a comprehensive survey of the state of the art in this field. The book is divided into two parts: scientific methodologies and application case studies. Part 1 consists of 13 chapters, which discuss major methods for planning and scheduling, including constructive approaches, iterative repair methods, integration of planning and scheduling, distributed schedulers, and constraint-based languages. Part 2 contains 12 chapters, which demonstrate applications of intelligent scheduling methods in the domains of space, semiconductor manufacturing, heavy manufacturing, and military transportation. Each chapter of the book presents an overview of a particular working system and the problems it can solve. The presentation style is informal. The book is valuable to researchers who want to gain an overall picture of the field. There is a rich collection of references at the end of each chapter. Practitioners in industry and government will find this book to be a rich source of methods to solve their management problems. It could also serve as a reference book for a seminar-based graduate course on knowledge-based planning and scheduling. Its use as the main text for a regular course is limited, however, due to its lack of uniformity and exercises.

L43    ANSWER 3 OF 33   COMPUSCIENCE   COPYRIGHT  1996 FIZ KARLSRUHE
       DUPLICATE 1
AN     95(6):MA18512   COMPUSCIENCE
TI     A tabu search procedure for the resource constrained project
       scheduling problem with discounted cash flows.
AU     Icmeli, Oya; Erenguc, S. Selcuk
SO     Comput. Oper. Res. (1994) v. 21(8) p. 841-853.
       1994.
DT     Journal
TC     Theoretical
CY     Germany, Federal Republic of
LA     English
IP     FIZKA
DN     812.90065
AB     The Resource Constrained Project Scheduling Problem with Discounted

Cash Flows (RCPSPDC) is considered. This problem involves scheduling the project activities with cash inflows and outflows, in such a way the net present value of the cash flows is maximized subject to resource and precedence constraints. A tabu search procedure was proposed (TABU-S) as a heuristic solution technique for this problem. The procedure was, then, modified to invoke a long term memory function (TABU-L). Both procedures were tested on 50 problems derived from Patterson's data set. Solutions produced by these procedures were compared to upper bounds obtained from a Linear Programming Relaxation of RCPSPDC which is strengthened by valid cuts. Furthermore, a comparison of these solutions to solutions obtained by Minimum Slack Heuristic was provided. In general, Tabu Search successfully produced near-optimal solutions with reasonable computational effort.     (Summary)

L43    ANSWER 4 OF 33   COMPUSCIENCE   COPYRIGHT  1996 FIZ KARLSRUHE
       DUPLICATE 2
AN     95(6):MA16681   COMPUSCIENCE
TI     Scheduling identical parallel machines to minimize total weighted
       completion time.
AU     Belouadah, H.; Potts, C. N.
SO     Discrete Appl. Math. (1994) v. 48(3) p. 201-218.
       1994.
DT     Journal
TC     Theoretical
CY     Germany, Federal Republic of
LA     English
IP     FIZKA
DN     809.90073
AB     A branch-and-bound algorithm is proposed for the problem of
       scheduling $n$ jobs with known integer processing times and weights
       on $m$ identical parallel machines with the objective to minimize
       total weighted completion time. The algorithm is based on a new
       lower bound which is derived by Lagrangean relaxation of the
       machine capacity constraints. Instead of determining the optimal
       parameter for the Lagrangean problem that gives the best lower
       bound a heuristic method is used. This allows to compute the lower
       bound efficiently. It is shown that the heuristic yields a lower
       bound that is exact when there is a single machine or when all jobs
       have unit processing times. To eliminates nodes from the search
       tree the authors present a new dominance rule. They give
       computational results which compare their branch-and-bound
       algorithm to previous ones and indicate the value of the new
       dominance rule.     (M. Middendorf (Karlsruhe))

L43    ANSWER 5 OF 33   COMPUAB    COPYRIGHT 1996 CSA
AN     94:16962   COMPUAB
TI     Scheduling products with bills of materials using an
       improved Lagrangian relaxation technique
AU     Czerwinski, Christopher S.; Luh, Peter B.
CS     Univ of Connecticut, Storrs, CT, USA

AB    A bill of materials specifies the sequence in which parts are to be
      processed and assembled in order to manufacture a derivable product.
      In practice, a bill of materials may be quite complex, involving
      hundreds of parts to be processed on a number of limited resources,
      making scheduling difficult. This has forced many
      practitioners to turn to Materials Requirements Planning
      and heuristic rules to perform scheduling. These
      methods are seldom integrated, however, resulting in unreliable
      completion times for products and, hence, low customer satisfaction.
      This paper addresses the issue of integrally scheduling
      parts that are related through a bill of materials for the purpose
      of improving the on-time performance of products as well as reducing
      work-in-progress (WIP) inventory. The technique presented here is
      based on an existing Lagrangian relaxation (LR) approach
      for the scheduling of independent parts in a job shop. The
      current problem, however, is more complicated than the job shop
      problem because of the constraints between parts, imposed
      by the bill of materials. In order to make the Lagrangian
   relaxation a viable approach to this problem, an auxiliary
      problem formulation with a modified subgradient method are adopted
      to improve the computation time of the existing LR approach. This
      improved LR approach allows the bill of material constraints
      to be considered directly in the problem formulation. Results to
      date show that the above integration improves product tardiness and
      WIP levels, compared to techniques that do not integrate the bill of
      material constraints into the product scheduling
      problem. The improved ability of a manufacturer to meet promised
      delivery dates for products by the above integration will ultimately
      enhance its credibility and competitiveness in the marketplace.

AB    We study the one machine scheduling problem with release and

delivery times and the minimum makespan objective, in the presence of constraints that for certain pairs of jobs require a delay between the completion of the first job and the start of the second (delayed precedence constraints). This problem arises naturally in the context of the Shifting Bottleneck Procedure for the general job shop scheduling problem, as a relaxation of the latter, tighter than the standard one machine relaxation. The paper first highlights the difference between the two relaxations through some relevant complexity results. Then it introduces a modified Longest Tail Heuristic whose analysis identifies those situations that permit efficient branching. As a result, an optimization algorithm is developed whose performance is comparable to that of the best algorithms for the standard one machine problem. Embedding this algorithm into a modified version of the Shifting Bottleneck Procedure that uses the tighter one machine relaxation discussed here results in a considerable overall improvement in performance on all classes of job shop scheduling problems.

AB      The present paper explores the tradeoff between the informedness
        and computational cost of two repair heuristics used in the GERRY
        scheduling system, namely {\it static} and {\it lookahead}
        measurement heuristics. GERRY (Zweben {\it et al.}; 1992) is a
        scheduling system that has been used operationally in the shuttle
        ground processing domain since early 1992, on the basis of {\it
        constraint-based iterative repair} when considering modifications
        to schedules. The experiments have shown that the selection of an
        efficient repair mechanism in a system such a GERRY depends at
        least in part on two problem characteristics: problem size and
        constraint tightness. {\it Static evaluation}, which is a less
        informed technique, serves better on larger and less constrained
        problems, while {\it lookahead techniques} are especially effective
        on more difficult and smaller problems. Clearly lookahead suffers
        in problems with many tasks, where the overhead of preserving
        temporal relations is substantial. It is apparent that the size of

the shuttle ground processing problem is a more dominating feature
than the tightness of its resource and state constraints. Another
observation is that when both static and lookahead methods reached
a cost of zero, the lookahead technique did so in a fewer number of
iterations. Thus the lookahead mechanism more often chose the best
repair candidate, even though it may have spent too much time in
doing so. As a general strategy, the authors recommend that early
in the repair process it is better to perform {\it some} kind of
repair quickly, instead of wasting time evaluating which repair
will reduce the cost by the greatest amount. But later in the
repair process as the system is attempting to resolve a final few
tough violations, the lookahead heuristic becomes more necessary to
make productive moves in a timely manner.

L43  ANSWER 8 OF 33  COMPUAB    COPYRIGHT 1996 CSA
AN   94:224  COMPUAB
TI   Capacitated lot-sizing with minimum batch sizes and setup times.
AU   Anderson, Edward J.; Cheah, Boon Soon
CS   Univ of Cambridge, Cambridge, UK
SO   INT J PROD ECON., (1993) vol. 30-31, pp. 137-152.
     Meeting Info.: Proceedings of the Seventh International Working
     Seminar on Production Economics. Innsbruck, Austria. 02/17-21/92.
     ISSN: 0925-5273.
DT   Journal
TC   Conference
FS   C
LA   English
AB   A multi-item, capacitated lot-sizing problem is introduced in which
     the effects of setups are modelled using minimum batch sizes and
     setup times. A heuristic algorithm for solving the problem
     is proposed. This is based on a Lagrangean relaxation of
     the capacity constrains which decomposes the problem into
     independent single-item subproblems. The single-item, uncapacitated
     subproblems can be solved using an algorithm based on dynamic
     programming. Computational experience with the heuristic
     is reported.

AN     795.90015    MATH
TI     Heuristic algorithms for the multiple depot vehicle scheduling
       problem
AU     Dell'Amico, Mauro; Fischetti, Matteo; Toth, Paolo
SO     Manage. Sci. 39, No. 1, 115-125 (1993).
DT     Journal
LA     English
AB     The paper deals with a vehicle scheduling algorithm which can be
       applied to a given set of trips for a given number of vehicles
       stationed at various depots so that the number of duties be minimal
       and the total operational cost as small as possible. The fact that
       there are several different depots and that each vehicle has to
       start and end its duty at the assigned depot makes the problem
       NP-hard. The authors give a brief survey of known heuristics for the
       above-mentioned problem and describe their own procedure.\par The
       procedure consists of two main parts. In the first part the problem
       is simplified by a multiple depot constraint-relaxation and an exact
       algorithm based on maximum independent set theory is used to obtain
       lower bound solution and the associated graph where some arcs are
       excluded. Then a feasible duty is formed as the shortest path in the
       graph. During the next steps of the first part the graph is updated
       and the next duty is found. The second part of the procedure
       involves four refinement algorithms which are repeatedly used to
       improve the current solution which originates from the first part of
       the procedure. All the mentioned refinement algorithms are based on
       exact methods used on a subproblem solution. The authors made
       extensive computational experiments on test problems of up to 1000
       trips and 10 depots and compared their procedure to well-known
       concurrent scheduler and two-phase algorithms. As far as the
       objective function value is concerned the reported results show that
       the new procedure gives much better solutions than previous
       algorithms.
            (J. Janacek (Zilina))

AN     94:221    COMPUAB
TI     Feedback production planning in a stochastic two-machine
       flowshop: Asymptotic analysis and computational results.
AU     Sethi, Suresh; Yan, Houmin; Zhang, Qing; Zhou, Xun Yu
CS     Univ of Toronto, Toronto, Ont, Can
SO     INT J PROD ECON., (1993) vol. 30-31, pp. 79-93.
       Meeting Info.: Proceedings of the Seventh International Working
       Seminar on Production Economics. Innsbruck, Austria. 02/17-21/92.
       ISSN: 0925-5273.
DT     Journal
TC     Conference
FS     C
LA     English
AB     This paper presents an asymptotic analysis of hierarchical

production planning in a manufacturing system with two
tandem machines that are subject to breakdown and repair.
Since the number of parts in the buffer between the two machines
needs to be non-negative, the problem is inherently a state
constrained problem. As the rate of machines breakdown and
repair approaches infinity, the analysis results in a
limiting problem in which the stochastic machine capacity is
replaced by the equilibrium mean capacity. The value function for
the original problem is proved to converge to the value function of
the limiting problem. This suggests a heuristic to
construct a feedback control for the original stochastic problem
from the feedback control of the limiting deterministic problem.
Computational results are presented to illustrate our
heuristic.

L43   · ANSWER 11 OF 33   COMPUSCIENCE   COPYRIGHT   1996 FIZ KARLSRUHE
AN      93(9):AC50665   COMPUSCIENCE
TI      High-level synthesis. introduction to chip and system design.
AU      Gajski, Daniel D.; Dutt, Nikil D.; Wu, Allen C.-H.; Lin, Steve
        Y.-L.
SO      Norwell, MA: Kluwer Academic Publishers. 1992. 359 p.
        ISBN: 0-7923-9194-2
DT      Book
LA      English
IP      ACM-CR
DN      9309-0665
AB      A hardware system can be represented at various levels of
        abstraction. The most common levels are the processor-memory-switch
        level, the instruction set level, the register transfer level, the
        logic level, the circuit level, and the mask level. The earlier
        levels concentrate on the behavior of the system. Structural
        attributes are added as one moves toward the lower levels. In
        practice, a strict top-down methodology of design that follows
        these levels of abstraction is not possible because of the intense
        dependency of the system on the constraints of the technology used.
        Two schools of thought have prevailed over the years. The
        describe-and-synthesize school strives to develop tools that
        accommodate the top-down design process as far as possible. The
        capture-and-simulation  school depends on the perceived method by
        which the designer normally works, that is, the target design is
        based on the previous designs the designer has been exposed to.
        This book tries to capture contemporary thinking in the
        describe-and-synthesize school. Chapters 1 and 2 introduce the
        basic system design process, basic models for combinatorial and
        sequential logic, and dataflow and control flow concepts. Chapter 3
        deals with the relationship between structural and physical designs
        and quality (area and performance) metrics. Chapter 4 concentrates
        on design representations and particularly hardware description
        languages (HDLs). Textual, graphical, and tabular HDLs are covered
        along with a sample of representative constructs in various types
        of HDLs. This chapter ends with basic modeling guidelines using

HDLs. Chapter 5 deals with design representation and
transformations. Data and control flow representations are
described, followed by the popular types of transformations
(compiler-based, flow-graph, and hardware-specific). Chapter 6
describes the basic partitioning methods (hierarchical clustering,
min-cut, and simulated annealing). Chip partitioning, unit
selection, and scheduling and binding concepts follow. Chapter 7
covers time- and resource-based scheduling. Methods of scheduling
with relaxed assumptions, simulated annealing, path-based
scheduling, and dataflow graph restructuring are dealt with here.
Chapter 8 provides the details of allocation algorithms to include
constructive, decomposition-based, and iterative refinement
approaches. Chapter 9 treats general issues in design methodologies
and high-level synthesis. The authors have tried to accommodate
three types of readers: CAD managers and system designers, CAD tool
developers, and advanced students in design automation. They have
done a superb job of addressing the issues of interest to all three
groups. Each chapter in the  book is essentially independent.
Chapters begin with an example, detail the problem and solutions,
describe well-known algorithms to solve that problem, survey the
work in that area, and end with a nice set of exercises. This book
is a good addition to the CAD tool designer's bookshelf.

L43    ANSWER 12 OF 33   COMPUAB     COPYRIGHT 1996 CSA
AN     93:1522   COMPUAB
TI     I-CAPE: an expert system for production planning in
       plastic molding factory.
       PROC 92 JPN USA SYMP FLEXIBLE AUTOM.
AU     Abe, Akihiro; Nagai, Akira; Ishiguro, Makio; Maeda, Tetsuji; Nakano,
       Go
CS     Matsushita Electric Ind. Co, Kawasaki, Japan
SO     (1992) pp. 1465-1472. ASME, NEW YORK, NY (USA).
       Meeting Info.: the 1992 Japan - USA Symposium on Flexible Automation
       Part 2 (of 2). San Francisco, CA, USA. 07/13-15/92.
DT     Book
TC     Conference
FS     C
LA     English
AB     Our plastic molding factory has a monthly output of more than
       250,000 electric irons consisting of hundreds of different types.
       The job of parts production planning for these products is
       becoming more and more complicated and difficult every year. We have
       developed an expert system I-CAPE which helps human planners to
       create parts production plans. We propose a new problem solving
       method based on the relaxation and reinforcement of
    constraints to create a schedule efficiently. I-CAPE
       automatically generates a production schedule and tests its
       feasibility by using heuristics obtained from a planner.
       I-CAPE also provides a graphic interface which enables human
       planners to understand the generated schedule easily and to
       intervene at any point in the scheduling process to adjust

the schedule to fit the current status of the factory. I-CAPE has been deployed for daily operational use in our factory. I-CAPE has been favorably received by human planners, because it has proved to have many benefits for them. The planning time has been shortened from 7 days to 1 day, and 25% of the inventory-carrying cost has been saved. Furthermore I-CAPE enables the building of total manufacturing system whose aim is to closely couple the demands of the market and production management.

L43   ANSWER 13 OF 33   MATH   COPYRIGHT 1996 FIZ KARLSRUHE
AN    745.90037   MATH
TI    Exchanges procedures for timetabling problems.
AU    Ferland, Jacques A.; Lavoie, Alain
SO    Discrete Appl. Math. 35, No. 3, 237-253 (1992).
DT    Journal
LA    English
AB    Timetabling problems appear in several practical applications, and
      they can be formulated as 0-1 programming problems to determine an
      optimal assignment of items to resources minimizing total cost and
      satisfying $K$ additional side constraints. The proposed approach to
      deal with this problem is a heuristic iterative procedure where the
      assignment of one item is modified at each iteration. This exchange
      procedure is applied first to determine a feasible solution
      satisfying the side constraints, and then to improve the objective
      function. A geometric interpretation of an exchange is first given
      to induce a theoretical framework for the procedure. Furthermore,
      two other procedures are introduced to prevent jamming situations
      outside the feasible domain or at a local optimum. The first
      procedure uses inductively more than one exchange per iteration, and
      the second one relies on Lagrangean relaxation.
         (Summary)

L43   ANSWER 14 OF 33   COMPUSCIENCE   COPYRIGHT  1996 FIZ KARLSRUHE
      DUPLICATE 3
AN    94(1):AC50049   COMPUSCIENCE
TI    Minimizing conflicts. a heuristic repair method for constraint
      satisfaction and scheduling problems.
AU    Minton, Steven; Johnston, Mark D.; Philips, Andrew B.; Laird,
      Philip
SO    Artificial Intelligence. (Dec. 1992) vol. 58(1-3) p.161-205.
      Special volume on constraint-based reasoning.
      ISSN: 0004-3702
DT    Journal
LA    English
IP    ACM-CR
DN    9401-0049
AB    Repair heuristics have already proven successful for solving
      combinatorial search problems. The authors try to underline their
      importance for constraint satisfaction problems (CSPs), where a
      constructive, backtracking approach is customary. The trigger for
      their work and this well-written paper was the performance of a

neural network developed for a complex task: scheduling the Hubble
Space Telescope. The analysis of this problem has led the authors
to suggest that repair-based methods can perform better than
constructive methods because a complete assignment, although
inconsistent, provides more information in guiding a search than a
partial assignment. They identify a powerful heuristic, namely
selecting the repair that minimizes the number of conflicts, but
admit that its usefulness is domain-dependent and affected by
several factors, such as the expected distance between the initial
assignment and the solution. These conjectures are sustained by a
statistical model for CSP repair. The authors have implemented
their ideas in a symbolic CSP that offers the opportunity of
employing different search strategies and hence opens another area
for future research. Hill-climbing seems to be more appropriate
than other search methods to at least capture the essential
characteristics of the original network. Other experiments the
authors report and analyze include the N-queens problem and graph
coloring. The paper's main achievement is that it enforces
open-mindedness with respect to applying repair heuristics.
Min-conflicts'' performance  on such a well-studied case as the
N-queens problem is certainly an argument. The possibility of using
the heuristic in combination with informed backtracking algorithms
is another.

L43    ANSWER 15 OF 33   COMPUSCIENCE   COPYRIGHT  1996 FIZ KARLSRUHE
       DUPLICATE 4
AN     95(3):MA5991   COMPUSCIENCE
TI     Minimizing conflicts: A heuristic repair method for constraint
       satisfaction and scheduling problems.
AU     Minton, Steven; Johnston, Mark D.; Philips, Andrew B.; Laird,
       Philip
SO     Artif. Intell. (1992) v. 58(1-3) p. 161-205.
       1992.
DT     Journal
TC     Theoretical
CY     Germany, Federal Republic of
LA     English
IP     FIZKA
DN     782.90054
AB     The paper describes a simple heuristic approach for solving
       large-scale constraint satisfaction and scheduling problems. In
       this approach one starts with an inconsistent assignment for a set
       of variables and searches through the space of possible repairs.
       The search can be guided by a value-ordering heuristic, the
       min-conflicts heuristic, that attempts to minimize the number of
       constraint violations after each step. The heuristic can be used
       with a variety of different search strategies. par We demonstrate
       empirically that on the $n$-queens problem, a technique based on
       this approach performs oders of magnitude better than traditional
       backtracking techniques. We also describe a scheduling application
       where the approach has been used successfully. A theoretical

analysis is presented both to explain why this method works well on certain types of problems and to predict when it is likely to be most effective.      (Summary)

L43   ANSWER 16 OF 33   COMPUAB      COPYRIGHT 1996 CSA
AN    93:1261   COMPUAB
TI    Balancing antagonistic time and resource utilization
   constraints in over-subscribed scheduling
      problems.
      PROC CONF ARTIF INTELL APPL.
AU    Smith, Stephen F.; Pathak, Dhiraj K.
SO    (1992) pp. 113-119. IEEE, IEEE SERVICE CENTER, PISCATAWAY, NJ (USA).
      Meeting Info.: the 8th Conference on Artificial Intelligence for
      Applications. Monterey, CA, USA.
      ISBN: 0-8186-2690-2.
DT    Book
TC    Conference
FS    C
LA    English
AB    Previous research has demonstrated the utility of constraint
      -based problem structuring and multiperspective scheduling
      for effective balancing conflicting objects in constraint-
   relaxable scheduling problems. Work aimed at
      applying these concepts to over-subscribed scheduling
      problems is discussed. The focus is on the problem of constructing
      short-term schedules for the Hubble Space Telescope, where complex
      state-dependent constraints on resource utilization
      interact antagonistically with the ability to satisfy absolute time
   constraints on execution of goal activities. Two
      time-bounded heuristic scheduling strategies
      were defined. The performance of each in balancing this tradeoff was
      studied experimentally. On the basis of results indicating the
      differential superiority of each strategy, a composite
      multiperspective strategy based on recognition of characteristics of
      the current problem-solving state is defined. Its experimental
      performance indicates the benefits of constraint-based
      problem structuring in over-subscribed domains.


L43   ANSWER 17 OF 33   MATH   COPYRIGHT 1996 FIZ KARLSRUHE
AN    728.90046   MATH
TI    Machine scheduling and Lagrangian relaxation.
AU    Velde, Steven Leendert van de
SO    Amsterdam: CWI; Also: Tech Univ. Eindhoven, Thesis. 139 p. (1991).
DT    Dissertation
LA    English
AB    This thesis describes how Lagrangean relaxation can be used to
      generate exact and approximate solutions to a variety of machine
      scheduling problems. A special feature is that an ascent method is
      proposed to tackle each Lagrangean dual problem. The first chapter
      gives an introduction to machine scheduling problems and provides a
      thorough review of Lagrangean duality theory. The problem of

scheduling jobs with precedence constraints on a single machine to
minimize total weighted completion time is considered in the second
chapter. Based on a Lagrangean relaxation of the precedence
constraints, the problem is decomposed: an approximate solution of
the original problem is obtained by solving each subproblem by
dynamic programming. In each of the next three chapters, the lower
bounds obtained from dual ascent procedures are incorporated into
branch and bound algorithms for which extensive computational tests
are performed. The third chapter deals with the problem of
minimizing total completion time in a two-machine flow-shop; the
precedence constraints between the operations of the jobs are
dualized. The fourth chapter considers the problem of scheduling
unrelated parallel machines to minimize the maximum completion time;
the constraints which ensure that the maximum completion time cannot
be less than the completion time of the last job on any machine are
dualized. The fifth chapter studies the problem of scheduling jobs
with a common due date on a single machine to minimize the total
earliness plus the total tardiness; the constraint which ensures
that the total processing of non-late jobs cannot exceed the due
date is dualized. Finally, the problem of scheduling a single
machine to minimize weighted total completion time plus weighted
total earliness is considered in the sixth chapter. Various lower
bounds are derived and tested in a branch and bound algorithm.
      (C. N. Potts (Southampton).)

L43    ANSWER 18 OF 33   COMPUSCIENCE   COPYRIGHT   1996 FIZ KARLSRUHE
AN     92(3):MA1998   COMPUSCIENCE
TI     Machine scheduling and Lagrangian relaxation.
AU     Velde, Steven Leendert van de
CS     CWI
SO     Amsterdam:  1991. 139 p
DT     Book; Dissertation
LA     English
IP     FIZKA
DN     728.90046
AB     This thesis describes how Lagrangean relaxation can be used to
       generate exact and approximate solutions to a variety of machine
       scheduling problems. A special feature is that an ascent method is
       proposed to tackle each Lagrangean dual problem. The first chapter
       gives an introduction to machine scheduling problems and provides a
       thorough review of Lagrangean duality theory. The problem of
       scheduling jobs with precedence constraints on a single machine to
       minimize total weighted completion time is considered in the second
       chapter. Based on a Lagrangean relaxation of the precedence
       constraints, the problem is decomposed: an approximate solution of
       the original problem is obtained by solving each subproblem by
       dynamic programming. In each of the next three chapters, the lower
       bounds obtained from dual ascent procedures are incorporated into
       branch and bound algorithms for which extensive computational tests
       are performed. The third chapter deals with the problem of
       minimizing total completion time in a two-machine flow-shop; the

precedence constraints between the operations of the jobs are
dualized. The fourth chapter considers the problem of scheduling
unrelated parallel machines to minimize the maximum completion
time; the constraints which ensure that the maximum completion time
cannot be less than the completion time of the last job on any
machine are dualized. The fifth chapter studies the problem of
scheduling jobs with a common due date on a single machine to
minimize the total earliness plus the total tardiness; the
constraint which ensures that the total processing of non-late jobs
cannot exceed the due date is dualized. Finally, the problem of
scheduling a single machine to minimize weighted total completion
time plus weighted total earliness is considered in the sixth
chapter. Various lower bounds are derived and tested in a branch
and bound algorithm

L43   ANSWER 19 OF 33   MATH   COPYRIGHT 1996 FIZ KARLSRUHE
AN    742.90049   MATH
TI    An algorithm for solving dynamic capacitated plant location problems
      with discrete expansion sizes.
AU    Shulman, Alexander
SO    Oper. Res. 39, No. 3, 423-436 (1991).
DT    Journal
LA    English
AB    Suppose the demands at different points are known during several
      time periods. These demands have to be satisfied in each period by
      either priorily existing or new facilities of possibly different
      capacities. The new facilities have to be located among given sites,
      for each of which it is known which types of facility and in what
      number it may accomodate. For each time period the setup costs for
      any facility type at each site, a variable cost per unit of demand
      served by each type of facility (independent of its location), and
      the transportation costs per unit of demand between any site and any
      demand point (independent of facility type) are given.\par The
      problem studied consists of determining the schedule of new facility
      placements and the way to meet all demands during each period,
      minimizing the total costs over the complete planning horizon. A
      mixed 0-1 linear formulation is derived. A Lagrangian relaxation is
      obtained by relaxing the demand constraints. The obtained
      subproblems are solved by dynamic programming, which is exponential
      in the general case. For the case where mixing of facilities of
      different types at the same location is not allowed, the subproblems
      turn out to be polynomially solvable. In this case two heuristics
      are also described for deriving feasible solutions from infeasible
      ones obtained in the subproblems. Some computational experience is
      given.
            (F. Plastria (Brussels))

L43   ANSWER 20 OF 33   COMPUSCIENCE   COPYRIGHT  1996 FIZ KARLSRUHE
      DUPLICATE 5
AN    92(1):MA4321   COMPUSCIENCE
TI    A new heuristic solution method in resource-constrained project

scheduling.
AB    A new heuristic method is presented for the resolution of multiresource constrained conflicts in project scheduling. In attempting to find a minimal makespan solution, the algorithm employs a simple procedure to generate a feasible solution with no backtracking. A postanalysis phase then applies a hill-climbing search. The solution method is different from existing heuristic methods in that it repairs resource conflicts rather than constructs detailed schedules by dispatching activities. Resource-violating sets of activities are identified which must be prevented from concurrent execution because this would violate resource constraints. Repairs are made by imposing an arc to sequence two activities in such a resource violating set. Computational results are compared with those of existing heuristics for the minimal makespan problem

AN    91:9743   COMPUAB
TI    A nonlinear minimax allocation problem with multiple knapsack
      constraints.
AU    Luss, H.
CS    AT&T Bell Lab., Holmdel, NJ 07733, USA
SO    OPER. RES. LETT., (1991) vol. 10, no. 4, pp. 183-187.
DT    Journal
FS    C
LA    English
SL    English
AB    We consider a nonlinear minimax allocation problem with multiple
      knapsack-type resource constraints. Each term in the
      objective function is a nonlinear, strictly decreasing and
      continuous function of a single variable. All variables are
      continuous and nonnegative. A previous algorithm for such problems
      repeatedly solves relaxed problems without the
      nonnegativity constraints. That algorithm is particularly
      efficient for certain nonlinear functions for which there are
      closed-form solutions for the relaxed problems; for other
      functions, however, the algorithm must employ search methods. We
      present a new algorithm that uses at each iteration
      simple-to-compute algebraic expressions to check optimality
      conditions, instead of solving the relaxed minimax
      problems. The new algorithm is therefore significantly more
      efficient for more general nonlinear functions.

AN    91(12):MA4024   COMPUSCIENCE
TI    Routing in point-to-point delivery systems: Formulations and
      solution heuristics.
AU    Leung, Janny M. Y.; Magnanti, Thomas L.; Singhal, Vijay
SO    Transp. Sci. (1990) v. 24(4) p. 245-260.
DT    Journal
LA    English
IP    FIZKA
DN    723.90019
AB    We develop an optimization-based approach for a point-to-point
      route planning problem that arises in many large scale delivery
      systems (for example, less-than-truckload freight, rail, mail and
      package delivery, communications). In these settings, a firm which
      must ship goods between many origin and destination pairs on a
      network needs to specify a route for each origin-destination pair
      so as to minimize transportation costs and / or transit times.
      Typically, the cost structure is very complicated. The approach
      discussed in this paper exploits the structure of the problem to
      decompose it into two smaller subproblems, each amenable to
      solution by a combination of optimization and heuristic techniques.
      One subproblem is an "assignment" problem with capacity

constraints. The other subproblem is a mixed-integer multicommodity
flow problem. We propose solution methods based on Lagrangian
relaxation for each subproblem. Computational results with these
methods and with a heuristic procedure for the multicommodity flow
problem on a problem met in practice are encouraging and suggest
that mathematical programming methods can be successfully applied
to large-scale problems in delivery systems planning and other
problems in logistical system design

AB      Four approaches to assigning and scheduling tasks to processors
        were modeled in an attempt to examine tradeoffs of achieving
        maximum parallelism simultaneously with minimum communications
        overhead. This paper focuses on the scheduling of
        precedence-constrained tasks across a network of identical
        processors. The paper's objective is to compare performance of
        several heuristics on test problems for fully connected networks
        versus networks in the hypercube configuration. In a fully
        connected network, each pair of processors is connected by an
        identical communication link. In a hypercube configuration, a {\it
        p}-order hypercube consists of {\it n} processors, where {\it
        n}\kern2pt\relax =\kern2pt\relax 2\kern2pt\relax ${} {{\it p}}$,
        connected so that {\it p}\kern2pt\relax =\kern2pt\relax
        log\kern2pt\relax ${}_{2}$\kern2pt\relax {\it n} processors are
        directly connected and the maximum number of links separating any
        two processors is also {\it p}. Task communications in a hypercube
        are achieved using messaging rather than shared memory. Both
        configurations were tested using simulation models and ten sets of
        systematically generated test data developed by the authors.
        Results of computational experimentation using the models developed
        provided a comparative analysis of the performance of four
        approaches across the two basic network configurations. The four
        approaches consisted of three simple heuristic algorithms and one
        algorithm using optimization by simulated annealing. The first
        approach was the ``list heuristic,'' in which tasks were sorted in
        order of increasing communications requirements; each task was
        scheduled on a processor at the earliest time possible such that
        communication with assigned tasks was minimized and subject to
        processing constraints. The second approach was the ``cluster
        heuristic,'' in which clusters of pair-wise communicating tasks are
        assigned to processors such that loads are balanced between
        processors to prevent large clusters that would result in poor

processor utilization. The third approach was the ``exchange heuristic.'' This approach involves an iterative improvement algorithm in which pair-wise exchanges of tasks between processors are performed to decrease communication costs within the precedence constraints. The fourth approach was simulated annealing, in which a parameter is slowly reduced, causing a coarse global search for optimality to evolve into a fine local search with probabilistic ``jumps'' allowing for an escape from non-global optima. The assumptions underlying the models used in this evaluation included the static allocation and sequencing of tasks in a deterministic environment. These assumptions limit the generalizability of the results in real situations, which tend to be neither static nor deterministic. Nevertheless, the analysis presented is a good initial evaluation of relationships between the degree of parallelism established in a distributed system and associated communications overhead. This paper provides insight into the appropriate application of each method of scheduling distributed task systems. The authors' objectives were to minimize both interprocessor communication and total execution time while meeting the precedence constraints imposed on the task system. Overall, it was found that the list scheduler outperformed the other two simple heuristic methods. Simulated annealing produced an average 23\% improvement over communications costs associated with the simple heuristics approaches, and 7\% over the best communication costs produced by any of the simple heuristic approaches. Thus, simulated annealing has advantages over the other methods studied. This may be practical if the required additional computation time needed for simulated annealing is available. List, cluster, exchange, and simulated annealing heuristics produced, respectively, 73\%, 63\%, 54\%, and 60\% higher communication costs in hypercube configurations than in fully connected network configurations. These results contradict the assumption made by many software developers that the hypercube topology is a close approximation to a fully connected network topology.

L43     ANSWER 24 OF 33   COMPUSCIENCE   COPYRIGHT   1996 FIZ KARLSRUHE
        DUPLICATE 7
AN      90(7):MA1702   COMPUSCIENCE
TI      Solving resource-constrained project scheduling problems by A*
        search.
AU      Bell, Colin E.; Park, Kwangho
SO      Nav. Res. Logist. (1990) v. 37 (1) p. 61-84.
DT      Journal
LA      English
IP      FIZKA
DN      684.90054
AB      A new exact method is presented for finding a minimum makespan
        schedule for a multiresource constrained project scheduling
        problem. This method employs the philosophical approach used
        earlier to develop a successful heuristic algorithm for the same
        class of problems. The approach repairs resource conflicts rather

than constructing detailed schedules by dispatching activities.
Resource-violating sets of activities are identified whose
concurrent execution would violate resource constraints. Repairs
are made by imposing a precedence constraint to sequence two
activities in such a resource-violating set. Computational results
are discussed for a standard set of test problems. An A* algorithm
is employed. The most successful version of our algorithm involves
some perhaps surprising design choices which might be relevant to
the design of A* -like search algorithms in other contexts

L43   ANSWER 25 OF 33   MATH   COPYRIGHT 1996 FIZ KARLSRUHE
AN    684.90029   MATH
TI    Rounding off to powers of two in continuous relaxations of
      capacitated lot sizing problems.
AU    Roundy, Robin
SO    Manage. Sci. 35, No. 12, 1433-1442 (1989).
DT    Journal
LA    English
AB    In the capacitated version of the Divide and Conquer algorithm for
      lot sizing in multi-stage production / inventory problems,
      feasibility is often lost when the reorder intervals are rounded off
      to powers of two. We propose a new algorithm for rounding off the
      reorder intervals which always produces a feasible policy. We have
      shown that the relative increase in cost that occurs when the
      intervals are rounded off using this algorithm cannot exceed 44 %,
      and that for systems with a single capacity-constrained machine
      (including the ELSP), the cost increase cannot exceed 6 %.
      Computational experience with industrial data sets indicates that
      the algorithm performs very well.

L43   ANSWER 26 OF 33   COMPUAB     COPYRIGHT 1996 CSA     DUPLICATE 8
AN    89:7740   COMPUAB
TI    A new integer programming formulation for the permutation flowshop
      problem.
AU    Frieze, A.M.; Yadegar, J.
CS    Dep. Math., Carnegie-Mellon Univ., Pittsburgh, PA 15213, USA
SO    EUR. J. OPER. RES., (1989) vol. 40, no. 1, pp. 90-98.
DT    Journal
FS    C
LA    English
SL    English
AB    The authors describe a new integer programming formulation for the
      permutation flowshop problem in which the objective is to minimise
      the makespan. This formulation can have an exponential number of
    constraints, but its linear programming relaxation
      can be solved by a novel (row generation) algorithm in polynomial
      time.

L43   ANSWER 27 OF 33   COMPUSCIENCE   COPYRIGHT  1996 FIZ KARLSRUHE
AN    89(10):MA3209   COMPUSCIENCE
TI    Maximum-entropy and Bayesian methods in science and engineering.

AB    [The articles of this volume will not be reviewed individually.]
The two volumes present a wide variety of topics by leading
reseachers in the fields: Bayesian spectrum analysis, Bayesian
inductive inference, uncertainty and measurement, search for
extra-terrestial intelligence, inductive reasoning by neural
networks, information theory in biology, expert systems,
generalized inhomogeneous systems, and beamforming. E. T. Jaynes
presents four papers. The first one is a beautiful, detailed
tutorial on the Cox-Polya-Jaynes approach to Bayesian probability
theory and the maximum-entropy principle. The second paper briefly
describes the great conceptual differences, and equally great
mathematical similarities, of Bayesian and ME methods. Jaynes' next
paper is based on Bretthorst's contribution mentioned below. Jaynes
speculates on appropriate data analysis methods, making use of
probability theory to perform the optimal deconvolution of the
point-spread function. In his last paper, he shows the evolution of
Carnot's principle, via the lines of Kelvin, Clausius, Gibbs and
Boltzmann directly from first principles of inference. In G. L.
Bretthorst's paper, the Jaynes' approach to periodograms is studied
as a sufficient statistic for determining the spectrum of a time
sampled data set containing a single stationary frequency. He
extends this analysis and explicitly calculates the joint posterior
probability that multiple frequencies are present, independent of
their amplitude and phase, and the noise level. Results are given
for computer simulated data and for real data ranging from magnetic
resonance and astronomy to economic cycles. Fourier transform
methods are used for substantial improvements in resolution. The
material on which M. Tribus' paper is based, is scattered
throughout the literature and seldom brought together in a coherent
whole. In this presentation, many difficult steps in mathematics
are skipped so as to bring out the flow of ideas. S. F. Gull
applies the principles of Bayesian reasoning to problems of
inference from data sampled from Poisson, Gaussian and Cauchy
distributions. Probability distributions (prior and likelihoods)
are assigned in appropriate hypotheses spaces using the ME
principle, and then treated via Bayes' theorem. Since Bayesian
hypothesis testing requires careful consideration of the prior
ranges of any parameter involved, a quantitative statement of
Occams' Razor is proposed. As an example, Gull offers a solution to
a problem in egression analysis: determination of the optimal
number of parameters for fitting graphical data with a set of basis
functions. J. Rissanen presents an outline of a modeling principle

based upon the search for the shortest code length of the data. The stochastic complexity is defined. This principle is generally applicable to statistical problems, and when restricted to the special exponential family, arising in the ME formalism with a set of moment constraints, it provides a generalization which permits the treatment of constraints or their number to be optimized as well. J. Skilling presents the ME method as a universal one for finding a "best" positive distribution constrained by incomplete data. The justification of this approach is based upon four axioms: subset independence, coordinate invariance, system independence and scaling. C. C. Rodriguez makes use of a simple paradox to introduce new noninformative priors and to point out the connections between the state of knowledge of "total ignorance" and self-similarity. Generalization of these considerations could produce useful results for the artificial intelligence problem of knowledge representation. P. F. Fougere presents some methods of ME calculations on a discrete probability space; B. R. Frieden's and J. Makhoul's criticisms of the ME principle are answered here. R. Blankenbecler and M. H. Partovi present a discussion of the determination of the quantum density matrix from realistic measurements using the ME principle. A. J. M. Garret reviews recent suggestions on how to extend the uncertainty principle, by using the concept of information. The Heisenberg variance principle is shown to be a special case for canonically conjugate continuous variables. The possibility of further generalization is considered. M. H. Partovi and R. Blankenbecler present a discussion on their microstatistical formalism for multitime quantum measurements. They show that this formalism is capable of dealing with time in quantum mechanics in a rigorous way, and enables one to precisely state and derive time-energy uncertainty relations. Application to the problem of the quantum limit of accuracy of position measurements in the context of gravitational wave detection is briefly discussed. R. N. Madan discusses the problem of estimation of parameters in a Rayleigh distribution modified to take into account additional information. A new type of entropy estimator is proposed which is the ratio of the arithmetic mean to the geometric mean, times a normalized constant. This estimator is numerically compared with some other estimators. N. C. Dalkey describes a logic of information systems as a lattice with the information systems as elements. The partial order in this lattice is defined by a partial order in the expected payoff space. Possibilities of applications are demonstrated by means of an empirical example. The presented model is highly important for artificial intelligence methods. G. J. Klir presents methodological principles of uncertainty: nonspecifity, fuzzines, dissonance, and confusion. Well justifid measures of these types of uncertainty are described. N. C. Dalkey compares the minimum cross-entropy inference with minimally informative information systems. He shows that formulating inductive inference rules in terms of information systems, rather than probability distributions, is likely to generate stronger procedures. S. R. Deans explains the connections between search for

extraterrestial intelligence (SETI), Radon transforms, and optimization. He reports recent observations by the NASA-SETI team using prototype SETI hardware, and outlines a data analysis problem facing the Microwave Observing Project; furthermore he gives some preliminary results that may prove useful for the solution of the data analysis problem. An application of SETI, for processing a prodigious amount of data in real time, is shown. D. Hestenes discusses underlying network design principles and mechanisms of human perception, and explains their relation to theories of signal processing and statistical inference. C. C. Rodriguez studies asymptotic efficiency in nonparametric models. He is concerned with nonparametric models where the set of elementary events is a fixed compact subset of the real line and involves a fixed bounded function. Y. Tikochinsky and S. Shalitin review the Wigner formulation of quantum mechanics in phase space. Using this formulation, the classical limit of the quantum mechanical description of a system characterized by a given sharp value of an observable, or by a given expectation value of the same obsevable, is discussed. A. K. Rajagopal, P. J. Lin-Chung and S. Teitler consider superposition of probability amplitudes whose squared magnitude represents a probability density. Their particular interest is in characterization of weighting and interference effects as revealed by the properties of the corresponding differential entropy and Kullback-Leibler information. Some inequalities arising from both these effects are established. In L. H. Schick's paper, the ME principle is combined with the usual form of the variational principle in quantum mechanics to obtain super-variational principles, which may be used when the form of the potential energy operator is partially, or wholly unknown. Details are worked out for a few simple bound-state problems. Possible generalizations are discussed. A. K. Rajagopal and S. Teitler show explicitly for the case of particle statistics that the Boltzmann principle is an approximation to Einstein's reversal when the entropy is the Shannon entropy in an appropriate physical context. C. T. Lee proves that the classical entropy of a coherent state of an N-spin system is a local minimum. Here it is also conjectured that the ME is attained when the N points form a regular polyhedron. A. K. Rajagopal and S. Teitler present a further paper devoted to an approach to a density matrix form of the Heisenberg uncertainty relation which is to apply the ME principle for the density matrix subject to the given dispersions as constraints. They examine this approach from a somewhat different view-point to show several novel consequences of this formulation. Their principal interest is in the discussion of minimum uncertainty coherent states. In J. Skilling's paper, the direct f log f and indirect log f entropy formulae are used in ME spectroscopy. The direct form is shown to be appropriate for finding the single " best " spectrum from incomplete data. The author says that the indirect form should be used to find an underlying probability distribution function, but not the spectrum itself. Examples show how and why the indirect form is liable to

give misleading sharp spectra. T. D. Schneider suggests that the destructive tendency of the entropy to increase in isolated systems may also apply to the genetic material. R. K. Bryan shows areas where the ME method may prove useful in protein crystallography structure determination because the application of classical methods of phase determination is not always possible. In his next paper he shows how the deconvolution of X-ray crystallography images can be achieved by using the ME method, where prior knowledge of the particle radius is imposed. The deconvolution is combined with the Radon problem, so that the averaged radial density distribution of the particle is calculated, and the parameters defining the contrast transfer function are also refined as they are not known precisely. R. G. Currie studies climatically induced cyclic variations in United States' crop production. He explains why evidence for the "Kuznet's long swing" effect in aggregate economic data began to deteriorate after the turn of the century. A. Lippman considers ME methods for the construction of expert systems. He shows that the construction of an expert system is equivalent to the minimization of a convex function in as many dimensions as there are pieces of knowledge supplied by the system. S. Geman presents an introduction to stochastic relaxation, a highly parallel computational algorithm for various inference and optimization problems. The presentation is given by examples highlighting possible applications to image processing and expert systems. S. A. Farrow and F. P. Ottensmeyer show a method of bias correction in electron microscope images. This method is introduced by the use of the error fitting method in conjunction with an ME processing algorithm. S. A. Goldman and R. L. Rivest present a new way to compute probability distributions with ME satisfying a set of constraints. This method is integrated with the planning of data collection and tabulation. They show how adding constraints and performing the associated additional tabulations can substantially speed up computation by replacing the usual iterative techniques with a straight-forward computation. A. Mohammad-Djafari and G. Demoment show that the ME approach is appropriate for solving some inverse problems arising at different levels of various image restoration and reconstruction problems. M. J. Miller shows that, for the class of likelihood problems resulting from a complete-incomplete data specification in which the complete data x are not uniquely determined by the measured incomplete data y via some many-to-one set of mappings y = h(x ), the density which maximizes the entropy is identical to the conditional density of the complete data given the incomplete data which would be derived via rules of conditional probability. It is demonstrated that for the problem of spectrum estimation from finite data sets, this view results in the derivation of maximum-likelihood estimates of the Toeplitz constrained covariance parameters via an iterative maximization of the likelihood function. K. L. Ngai, A. K. Rajagopal and S. Teitler introduce the concept of epoch entropy for relaxation processes. The relations of empirical rules and evaluations of epoch entropy to some existing models of relaxations are indicated. S. A. Trugman

presents the application of ME methods to the study of
inhomogeneous systems. Both the structural and transport properties
of inhomogeneous systems are considered. P. M. Doyen uses ME
methods to infer the dimensions of cracks in granit rocks from
measurements of their hydraulic permeability and of their
electrical conductivy. J. H. Root, P. A. Egelstaff and B. G. Nickel
describe the application of ME methods for reducing truncation
effects in the three-dimensional inverse Fourier transforms for
liquid diffraction data. K. H. Norsworthy and P. N. Michels show
that the high sidelobes of random array beams arise principally
from the mishandling of absent data. New random array beamforming
methods are described. Finally, Y. Cheng and R. L. Kashyap compare
the evidence combination given the Bayesian method and Dempster's
rule. They show that the Dempster's method is narrower than that of
Bayes. All contributions in these volumes are of high level and
many results are important for further theoretical and empirical
investigations

L43   ANSWER 28 OF 33  MATH  COPYRIGHT 1996 FIZ KARLSRUHE
AN    611.90001   MATH
TI    Delivery of urban services. With a view towards applications in
      management science and operations research.
AU    (Savas, E. S.; Kocur, G.; Desrosiers, J.; Ferland, J.-A.; Rousseau,
      J.-M.; Lapalme, G.; Chapleau, L.; Bodin, L. D.; Sexton, T. R.;
      Kolesar, P.; Swersey, A. J.; Brandeau, M. L.; Larson, R. C.; Ahitur,
      N.; Berman, O.; Male, J. W.; Fram, S. L.; Kao, E. P. C.; Queyranne,
      M.; Corman, H.; Barnett, A.; Lofaso, A. J.)
      Editor(s): Swersey, Arthur J.; Ignall, Edward J.
SO    TIMS Studies in the Management Sciences, Vol. 22. Amsterdam etc.:
      North-Holland. VII, 274 p. $ 50.00; Dfl. 160.00 (1986).
DT    Book
LA    English
AB    The book consists of eleven papers, devoted to some "urban service
      delivery systems which are concerned with the allocation of
      resources to meet demand that varies over time and space... Except
      for sanitation and housing, each of the major areas has at least one
      paper" (from A. J. Swersey's "Introduction"). The first one,
      "Alternative structural models for delivering urban services" by E.
      S. Savas presents a conceptual model for defining and analyzing the
      role of government and / or private-sector institutions and
      institutional structures in delivering services in urban areas.
      There's no mathematical formulation of such a model but the problem
      structure (relations between institutional arrangements and
      functional areas) is informally presented in graphic and tabular
      form. The next three articles are concerned with the transportation
      area. G. Kocur's "An extended optimization model of an urban bus
      system with demand variation" contains an optimization model of a
      bus system. The system is represented as a continuous geometric
      representation of the bus network in polar coordinates consisting of
      route segments radially focused on the "central business district".
      The goal is to find best route spacing, route length, headway and

fare in an equilibrium framework with demand sensitive to service levels. The author proposes a linear model of this sensitivity, including - besides these four - still such variables as wait time, walk time, in-vehicle travel time, auto time and cost. All variables in the problem are treated as continuous quantities, so that calculus and Lagrange multipliers technique may be used to solve the optimization problem. Three objective functions (minimize deficit, maximize the difference of ridership minus deficit, maximize ridership subject to a deficit constraint) are included into the model. The analytic derivation of results for a particular case of the first of these optimization problems is presented. Some case examples are also examined for the third one. "TRANSCOL: a multi-period school bus routing and scheduling system" by J. Desrosiers, J.-A. Ferland, J.-M. Rousseau, G. Lapalme and L. Chapleau contains description of a modular system (implemented on the CYBER 173 at the University of Montreal) for plannig and organizing transportation of students in a large regional school system. The TRASCOL builds also the frame-school-timetables (more precisely: a schedule of the school starting and ending times in such a way that the same bus can be used on as many routes as possible). The objective is to minimize the number of run combinations taking place during a period. This problem can be formulated as a min-max 0-1 program (the authors present its formulation). After this problem has been solved the route scheduling may be done using a heuristic approach which involves solving a series of transportation problems. The idea of this iterative process is described sketchily. Results of the application of the system in practice are also presented. In "The multi-vehicle subscriber dial-a-ride problem" L. D. Bodin and T. R. Sexton develops an algorithm for the problem named in the title. This problem is formulated as a nonlinear 0-1 mixed integer programming problem. The authors developed two algorithms to solve them. The paper contains a description of the second of these, called "space-time heuristic" together with the "swapper algorithm" to reassign customers to improve the solution of the initial problem. These algorithms were implemented on the UNIVAC 1108 and tested on a set of data from Project Mobility in Baltimore, MD. Results of the test are presented. The next three articles are concerned with emergency services. "The deployment of urban emergency units: a survey" by P. Kolesar and A. J. Swersey describes in sections 1-5 the characteristics of police, fire and ambulance systems and surveys the methods which have been applied to deployment problems in these areas. The section 6 analyses two ordinary linear programming formulations related to the average travel time model and set covering model as examples of deterministic location models applied to the fire company allocation problem. M. L. Brandeau and R. C. Larsen in "Extending and applying the hypercube queueing model to deploy ambulances in Boston" present an overview of the hypercube model used as a planning tool to aid in long-term deployment of emergency service vehicles. The model is informally described in the exact and approximate versions; the former in improved variant

includes varying service times option, mean service time calibration option and an improved travel time estimation procedure ("Barriers algorithm"). The implementation of the model in Boston is described in detail. N. Ahitur and O. Berman ("Negotiating a coordination agreement between two adjacent service networks") consider a problem that arises when adjacent communities provide mutual aid to one another. The used queue model is an extension of the hypercube model. The managers of two service networks exchange information about probabilities of demand and supply of services. This develops into a negotiation process, considered as a cooperative game. Requests for service form queues (two cases are analysed: zero capacity queue and FIFO queue). The authors compare two approaches to the problem: the "overall view point" and its approximation, the "local view point"; the first one is more complex than the second and has no practical meaning. Some considerations about negotiating a service price are also presented. J. W. Male and S. L. Fram in "Allocating funds for repair of leaky water distribution systems" present several linear programming formulations in allocation problems named in the title. Three different objective functions are discussed: maximize water saved, maximize net benefits, maximize the equity involved in the distribution of funds (with respect to three different definitions of such an equity). These linear programs were tested on a synthetic data set, based on information from several sources, demonstrating the usefulness of the approach proposed. A manpower planning model with various skill levels and random demands is considered in "Aggregation in a two-stage stochastic program for manpower planning in the service sector" of E. P. C. Kao and M. Queyranne. The authors formulate the problem as a two-stage stochastic program with recourse. The first stage decisions determine the size and mix of regular-time work force for the entire planning horizon. The authors prove a theorem on the existence of an optimal solution of this (nonlinear) optimization problem. The second-stage decisions determine the overtime and external help needed to supplement the regular-time work force. The respective optimization problem is stated as a linear program having always a feasible solutions and a bounded optimal solution. Next, the authors propose an approach for aggregating the decision variables in both optimization problems, proving several lemmas and two theorems. The aggregation in the first-stage problem leads to a simple-variable convex minimization problem which may be solved by conventional one-dimensional methods. For the second-stage problem a bound on the aggregation error is provided and a case with no aggregation error is specified. The authors prove also two theorems concerning "a posteriori lower bounds" on the optimal value of the two-stage problem. The final two papers consider criminal practice problems. H. Corman in "The cost and benefits of mandatory sentencing: crime aversion through incarceration" examines the effects of mandatory sentencing on crime rates. No mathematical problems are formulated explicitly nor solved. In "On the optimal allocation of prison space", A. Barnett and A. J. Lofaso consider, how prison space should be appartioned among the members of a heterogenous criminal

class, taking as the objective the minimization of crime rates. Two
stochastic models of criminal behavior are considered with empirical
estimations of their key parameters: the Poisson-exponential model
of crimininality (due to Avi-Itzhak, Shinnar and others) with
modifications allowing correlation between the time spent in prison
and the overall length of a criminal carreer, and an age-dependent
model of Baland and Wilson.
   (S. Zabek.)

L43   ANSWER 29 OF 33   COMPUAB     COPYRIGHT 1996 CSA     DUPLICATE 9
AN    86:6927   COMPUAB
TI    The application of continuum methods to path planning.
AU    Buckley, C.E.
CS    Stanford Univ., Stanford, CA, USA
SO    DISS. ABST. INT. PT. B - SCI. & ENG., (1986) 240 pp. Order No. FAD
      DA8602459..
DT    Book
FS    C
LA    English
SL    English
AB    The problem of planning paths or trajectories for robot
      manipulators has received much interest of late. Heuristics
      for continuum path-planning based numeric descent
      algorithms, similar to those used to solve optimization problems,
      are considered. Criteria are identified for constraint
      represention to be useful for such algorithms, and path-
   planning constraints are checked against them.
      Efficient means were devised for computing this function for
      polyhedral sets. The developed method was related to the linear
      complementarity problem. Finally, based on these results, a
   relaxation algorithm for path planning was
      implemented and tested. Its results compared favorably with a
      recently reported combinatorial algorithm.

L43   ANSWER 30 OF 33   COMPUAB     COPYRIGHT 1996 CSA     DUPLICATE 10
AN    85:12864   COMPUAB
TI    Symmetric clustered traveling salesman problem.
AU    Jongens, K.; Volgenant, T.
CS    Inst. Actuariaat en Econ., Univ. Amsterdam, Burgemeester
      Tellegenhuis, Jodenbreestraat 23, 1011 NH, Amsterdam, Netherlands
SO    EUR. J. OPER. RES., (1985) vol. 19, no. 1, pp. 68-75.
DT    Journal
FS    C
LA    English
SL    English
AB    The clustered traveling salesman problem is the well-known standard
      problem with additional constraints: the cities are
      divided into groups and each group of cities (cluster) must be
      visited contiguously. The authors describe an extensive adaptation
      of an existing traveling salesman algorithm based on the 1-tree
   relaxation. In the Lagrangean approach a new multiplier is

introduced to improve the lower bounds. Furthermore they describe a
heuristic to find satisfactory upper bounds and discuss the
elimination of nonoptimal edges. The computational results are
satisfying and include random Euclidean problems up to 150 cities.

L43    ANSWER 31 OF 33   MATH   COPYRIGHT 1996 FIZ KARLSRUHE
AN     497.90074   MATH
TI     Solving symmetric vehicle routing problems asymmetrically.
AU     Leeuwen, P. H. van; Volgenant, A.
SO     Eur. J. Oper. Res. 12, 388-393 (1983).
DT     Journal
LA     English


L43    ANSWER 32 OF 33   COMPUAB     COPYRIGHT 1996 CSA
AN     83:831   COMPUAB
TI     Algorithm for single machine sequencing with release dates to
       minimize total weighted completion time.
AU     Hariri, A.M.A.; Potts, C.N.
CS     Dep. Math., Univ. Keele, UK
SO     DISCRETE APPL. MATH., (1983) vol. 5, no. 1, pp. 99-109.
       Meeting Info.: Stirling Conf. Combinatorial Optimiz.. U.K.. 24-28
       Aug 1981.
DT     Journal
TC     Conference
FS     C
LA     English
SL     English
AB     Each of n jobs is to be processed without interruption on a single
       machine which can handle only one job at a time. Each job becomes
       available for processing at its release date, requires a processing
       time and has a positive weight. Given a processing order of the
       jobs, the earliest completion time for each job can be computed. The
       objective is to find a processing order of the jobs which minimizes
       the sum of weighted completion times. A branch and bound algorithm
       for the problem is derived. Firstly a heuristic is
       presented which is used in calculating the lower bound. Then the
       lower bound is obtained by performing a Lagrangean
    relaxation of the release date constraints; the
       Lagrange multipliers are chosen so that the sequence generated by
       the heuristic is an optimum solution of the
    relaxed problem thus yielding a lower bound. A method to
       increase the lower bound by deriving improved constraints
       to replace the original release date constraints is given.


L43    ANSWER 33 OF 33   COMPUAB     COPYRIGHT 1996 CSA
AN     83:833   COMPUAB
TI     Surrogate duality relaxation for job shop
    scheduling.
AU     Fisher, M.L.; Lageweg, B.J.; Lenstra, J.K.; Rinnooy Kan, A.H.G.
CS     Wharton Sch., Univ. Pennsylvania, Philadelphia, PA, USA
SO     DISCRETE APPL. MATH., (1983) vol. 5, no. 1, pp. 65-75.

AB   Surrogate duality bounds for the job shop scheduling problem are obtained by replacing certain constraints by their weighted sum and strengthening the aggregate constraint by iterating over all possible weights. The constraints successively considered for this purpose are the capacity constraints on the machines and the precedence constraints determining the machine order for each job. The resulting relaxations are investigated from a theoretical and a computational point of view.